

# Socio-demographic Determinants, Patterns, and Treatment Outcomes of Dental Trauma Patients Treated at a Restorative Dentistry Unit, National Dental Teaching Hospital (NDTH), Sri Lanka

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## Abstract

**Aim:** This study aimed to determine the socio-demographic determinants, patterns, and treatment outcomes of dental trauma patients treated at a Restorative Dentistry Unit, National Dental Hospital (Teaching) (NDTH), Sri Lanka.

**Material and methods:** This retrospective hospital-based study analyzed data of a total sample of 422 patients according to age, gender, cause, number, and the type of traumatized teeth from the clinical records of traumatized patients. The sample consisted of patients who attended the Restorative Dentistry Unit A of NDTH, Sri Lanka for traumatic dental injuries between January 2017 to January 2021. The data covered the period from 1<sup>st</sup> January 2017 to 1<sup>st</sup> January 2021. This period comprised the pre-COVID-19 era, and the COVID-19 era commenced from 11<sup>th</sup> March 2020, with the detection of the first local case and first and second waves of the pandemic. The data were entered and analyzed using SPSS-21 Statistical Software Package. The data are presented by frequency distributions and chi-square test of statistical significance for group comparisons in selected variables.

**Results:** Patients presented with dental trauma reflected a wider age ranged from 3 to 71 years thus reflecting the vulnerability to dental trauma across all ages from toddlers to older adults from which 65.6% were males and 34.5% were females. Only 34.5% of the patients sought treatment on the same day or the following day, while the most frequent cause for dental trauma was a fall (57.6%). Maxillary central incisors were the most affected teeth of the permanent teeth, and 67.2% had sustained uncomplicated fractures involving only the enamel and dentine.

When considering the treatment outcomes, 62.1% of patients have received coronal restorations, 30.6% root canal treatments and 7.1% had undergone extractions. 13.7% had received other treatments such as splinting and another 7.3% have received extra-coronal restorations.

**Conclusions:** As emerged from the findings of the present study, there was a wide variation of ages from toddlers to older adults presented for restorative treatment due to dental trauma demonstrating their vulnerability across all ages overwhelmingly dominated by male gender. Almost two thirds of them received coronal restorations whilst nearly a one-third got root canal treatment as main outcome. Importantly, there was a significant delay in presenting for care among majority of patients for those traumatic injuries, it is therefore, strongly suggested that educational programs to be conducted for the public and parents of children to create awareness about the importance of seeking care for immediate management of traumatized teeth.

**Keywords:** COVID-19, Trauma, Dental Injuries, Falls, Home, Lockdown, Treatments outcomes.

## Introduction

Traumatic dental injury (TDI) impacts the teeth and/or other hard and soft tissues within and around the mouth and oral cavity region [1]. TDI are very common across the globe leading to 85% of patients having injuries in the oral region [2] which was revealed by a meta-analysis conducted in 2018 [3]. TDIs are frequently presented as serious and complex injuries of the dentoalveolar system. The prevalence of dental trauma varies depending on cultural and social factors [4]. Though these injuries are more common in certain age groups such as children and young adults, no individual is ever at zero risks across their activities of daily living [1]. Often, TDIs occur at a young age but could be observed in any age group [5]. TDI is not a disease condition but an outcome of numerous inevitable risk factors in life [1].

On most occasions, TDI involves anterior teeth and represents painful events that may result in complications such as crown discoloration, pulp necrosis, apical periodontitis, ankyloses, and inflammatory root resorption [1]. A Study showed show that dental trauma accounts for about 5% of all injuries leading to inpatient or outpatient treatment and the oral region is the sixth most frequently injured part of the body [6]. Tooth loss could result from the complications mentioned above or the primary event [7]. In addition to functional problems, TDIs may cause immeasurable psychological burdens and social issues by affecting the aesthetics and speech of the individual [8]. Immediate and appropriate management is required to minimize complications and save the affected tooth. Managing dental trauma is never the same and sometimes presents a greater challenge to the operator. Emergency management should be considered to begin at the time of injury rather than the time the patient first sees the dentist as this affects the recovery [1].

This highlights the importance of spreading awareness among the public about the basics of first aid and the importance of timely management of TDI. Even with a timely presentation, management of dental trauma is not an ordinary situation in daily dental practice [1]. There are many combinations of environmental influence and patient-related factors and diagnostic uncertainty, and possible long-term follow-up for the patient making every case exceptional [1]. Due to this reason, evidence-based practice is best recognized at the population level, where extensive data can provide valuable guidance. This highlights the importance of epidemiology or the study of patterns and causes of specific conditions such as dental trauma at the population level [1].

Voluminous published research describes TDI in global context. Nevertheless, only a few published studies such as pattern and causes of oral and maxillofacial injuries presented to a tertiary Care dental hospital in 2020 [9] and

pattern of traumatic dental injuries in children attending the university dental hospital in 2008 [10] are available on dental trauma in the Sri Lankan population. Furthermore, there is limited research on dental trauma and oral and maxillofacial injuries including dental trauma treatment services amidst COVID-19 global pandemic despite gaining recognition as a priority for treatment provision across the globe [9,11]. Against this backdrop, the present study aimed to explore the pattern of traumatic dental injuries and treatment outcomes of the patients who attended the National Dental Hospital (Teaching) in Colombo comparing pre-COVID-19 and COVID-19 eras.

## Materials and Methods

The present study was conducted at the restorative dental unit A of National Dental Teaching Hospital (NDTH) Colombo, Sri Lanka which is a premier, multispecialty tertiary care public dental hospital. Secondary data were gathered from all the patients who sought treatment for the dental traumatic injury at the restorative dental unit A from January 2017 to January 2021. The data extraction form was developed from an already validated, comprehensive oral and maxillofacial injury surveillance form which was used by oral and maxillofacial injury surveillance system at NDTH Sri Lanka [9]. The primary form was refined to be concise and user-friendly. The face validity of the form was obtained by a consultative expert panel comprised of specialists in oral and maxillofacial surgery, restorative dentistry, orthodontics, and dental public health [9]. It was pre-tested and previously validated at the NDHT Sri Lanka outpatient dental clinic [9]. Following the pretest certain questions were rephrased for better clarity. The form obtained information on socio-demographic data and the history of the traumatic dental injury. Regarding the history and the examination findings, the following information was gathered: date of the oral and maxillofacial injury, mechanism of injury, place of occurrence and specific information regarding the extent and severity of the injury related to the hard tissue and the soft tissue injury.

The formula for calculating a population proportion with absolute precision was used for calculation of the sample size [12] (Lwanga and Lemeshow, 1991)

$$N = \frac{Z^2 \times P(1-P)}{D^2}$$

N= the calculated sample size

Z= the critical value for the 95% confidence interval = 1.96

P= the prevalence of the health-related event

Expected prevalence was consider as 50%

D=desired absolute precision= 5%

$$\frac{N = (1.96)^2 \times 0.5 (1-0.5)}{(0.05)^2}$$

N = 384

Non response rate was considered as 10%

Minimum sample size required with allowance for non-respondents,  $384 + 38.4 = 422$

Dental trauma was classified based on the classification developed by Andreasen [13]. In the data extract form, TDI was categorized based on criteria stipulated by Surendra et al. [9], into dental injuries involving injuries to the hard dental tissues and pulp, injuries to the periodontal tissues, injuries to the supporting bone, injuries to gingiva or oral mucosa and injuries to the extra-oral soft tissue. Information related to the initial management carried out, time duration to complete the management and the number of visits the patient needed to attend to manage this condition were also recorded based on criteria developed for the present study. Finally, data were gathered regarding the long-term follow-up and related long-term complications due to the trauma. Main treatment outcomes were assessed as number of patients received coronal restorations, root canal treatments, extractions and all other types of treatment categorized as “other types”.

The principal investigator gathered data with the aid of a co-investigator. Both the principal investigator and the co-investigator were calibrated by a consultant dental surgeon in restorative dentistry at the NDTH Sri Lanka to avoid intra examiner variability.

The data were entered and analyzed using the SPSS-21 software package. Data analysis included descriptive statistics (frequency distribution and crosstabulation). Statistical significance for the association between dental injuries and age, sex, cause, type of trauma, and type of tooth was ascertained using the chi square test. The significance level was set at 5%. A logistic regression model would have been a better statistical model to find associated factors of

dental trauma among this cohort of patients, Nevertheless, within the descriptive purpose of the present study this was not attempted which will be accomplished in further research based on present findings.

Ethics approval was obtained from the Ethics Review Committee, Faculty of Medicine, Colombo (EC-21-015). The principal investigator will confidentially store all data extract forms and the digital copy of the database.

## Results

During the study period, 422 dental traumatic injuries (which had complete information for the variables used in the present study were selected whilst clinical records with incomplete information were excluded) and recorded among patients presented to the Restorative dental unit for further management. However, as the data were based on existing clinical records, recall biases and possible confounders such as the data were collected for routine patient care but not for study purposes and involvement of many dental surgeons could have influenced the present findings. Males dominated (65.6%) the sample. As to age, the study includes patients ranging from 3 to 71 years with a mean of 22.75 years. The dominant age group was between 11-20 years (33.9 %), followed by 0-10 years (25.1%), and 20–29 years (22.2%). The least trauma was observed in 31-40 years (11.2%). Among 21 to 40 years and above 40-year-old adults, 26% and 15% were observed, respectively. In all age groups, up to 40 years, males show predominant dental trauma than females. Also, among elderly participants of above 40 years, both genders seemed to have the risk of sustaining dental traumatic injuries, with slight female dominance (Table 1).

As illustrated in Table 2, most dental traumatic injury types were caused by falls (57.6%), and occupational injuries were as low as 0.5%. Other fewer common causes with descending order were, being hit by an object, sporting injuries, and assault, with respective percentages of 7.3%, 6.2%, and 5.2%. However, for all types of injuries, the relative contribution of road traffic accidents was considerably less (20.9%) compared to falls (57.6%).

**Table 1:** Distribution of TDI patients by age group and gender.

Age Category (in Years)									
Gender	<10 n (%)	11-15 n (%)	16-20 n (%)	21-25 n (%)	26-30 n (%)	31-35 n (%)	36-40 n (%)	>40 n (%)	Total number in each gender (%)
Male	60 (21.8)	61 (22.2)	47 (17.1)	30 (10.9)	17 (6.2)	18 (6.5)	11 (4.0)	31 (11.3)	275 (65.6%)
Female	45 (31.3)	26(18.1)	8 (5.6)	9 (6.3)	6 (4.2)	11 (7.6)	7 (4.9)	32 (22.2)	144 (34.4%)
<b>Total</b>	<b>105 (25.1)</b>	<b>87 (20.8)</b>	<b>55 (13.1)</b>	<b>39 (9.3)</b>	<b>23 (5.5)</b>	<b>29 (6.9)</b>	<b>18 (4.3)</b>	<b>63 (15.0)</b>	<b>419* (100.0)</b>

\* Total number was not 422 due to exclusion of 3-record forms due to missing information on age

**Table 2:** Distribution of TDI by mechanism.

Injury					
Mechanism	Dental Hard tissues and Pulp	Injuries to Periodontal tissues	Injury to Supporting bone	Injury to Gingiva and oral mucosa	Total number of each cause of injury
	n (%)	n (%)	n (%)	n (%)	n (%)
RTA	73 (21.8)	42 (24.3)	24 (64.9)	59 (35.8)	88 (20.9)
Sports Injury	19 (5.7)	9 (5.2)	0 (0)	7 (4.2)	26 (6.2)
Occupational injury	2 (0.6)	0 (0)	0 (0)	1 (0.6)	2 (0.5)
Fall	192 (57.3)	95 (54.9)	7 (18.9)	71 (43)	243 (57.6)
Violence/Assault	15 (4.5)	11 (6.4)	4 (10.8)	13 (7.9)	22 (5.2)
Hit by an Object	26 (7.8)	12 (6.9)	2 (5.4)	11 (6.7)	31 (7.3)
Other	8 (2.4)	4 (2.3)	0 (0)	3 (1.8)	10 (2.4)
	<b>335 (100)</b>	<b>173 (100)</b>	<b>37 (100)</b>	<b>165 (100)</b>	<b>422 (100)</b>

According to the percentage distribution of the type of dental traumatic injuries over the given period, injuries to dental hard tissue (79.4%) were the leading type, followed by periodontal injuries (41.0%) and gingivae and oral mucosa (39.1%). In contrast, the relative proportions of injuries to supporting bone (8.8%) was comparatively low.

As illustrated in Table 3, the majority of dental traumatic injuries occurred at home or in its vicinity (40.3%) compared to other places of occurrence.

As demonstrated in Table 4, Falls were the dominant mechanism of injury over other mechanisms among most of the age groups.

We tested the distribution of mechanism of dental

traumatic injury by gender. This was statistically significant ( $p=0.001$ ) (Table 5).

As demonstrated in Table 6, there was a total of 243 patients who sustained Dental traumatic injuries due to falls among 422 patients. Of these, 83.5% had fallen at home. Moreover, 6.5% of “hit by an object injury” and 1.8% of violence/assault inflicted injuries had occurred at home.

Among the injuries at the workplace, and education institutes, the fall injury was prominent with 32.4% and 71.3% respectively (Table 6).

As presented in Table 7, the majority (83.5%) of dental traumatic injuries caused by “falls” had occurred at home compared to dental traumatic injuries caused by the same

**Table 3:** Distribution of TDI by place of occurrence.

Injury					
Place of occurrence	Dental Hard tissues and Pulp	Injuries to Periodontal tissues	Injury to Supporting bone	Injury to Gingiva and oral mucosa	Total
	n (%)	n (%)	n (%)	n (%)	n (%)
Home/Residence	134 (40.0)	67 (38.7)	4 (10.8)	51 (30.9)	<b>170 (40.3)</b>
Workplace	30 (9)	17 (9.8)	4 (10.8)	18 (10.9)	<b>37 (8.8)</b>
Educational Institute	64 (19.1)	31 (17.9)	1 (2.7)	20 (12.1)	<b>80 (19.0)</b>
Other	84 (25.1)	52 (30.1)	24 (64.9)	70 (42.4)	<b>106 (25.1)</b>
Not recorded	23 (6.9)	6 (3.5)	4 (10.4)	6 (3.6)	<b>29 (6.9)</b>
<b>Total</b>	<b>335 (100)</b>	<b>173 (100)</b>	<b>37 (100)</b>	<b>165 (100)</b>	<b>422 (100)</b>

**Table 4:** Distribution of mechanism of injury by age Age Category (in Years).

	<10	11-15	16-20	21-25	26-30	31-35	36-40	>40	Total number in each group (%)
	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)	
Fall	86 (35.5)	68 (28.1)	17 (7)	11 (4.5)	7 (2.9)	11 (4.5)	9 (3.7)	33 (13.6)	242(100)
RTA	4 (4.7)	2 (2.3)	25 (29.1)	14 (16.3)	11 (12.8)	9 (9.9)	6 (7)	15 (17.4)	86(100)
Other	15 (16.5)	17 (18.7)	13 (14.3)	14 (15.4)	5 (5.5)	9 (10.5)	3 (3.3)	15 (16.5)	91(100)
<b>Total</b>	<b>105 (25.1)</b>	<b>87 (20.2)</b>	<b>55 (13.1)</b>	<b>39 (9.3)</b>	<b>23 (5.5)</b>	<b>29 (6.9)</b>	<b>18 (4.3)</b>	<b>63 (15)</b>	<b>419*(100)</b>

\* Total number was not 422 due to exclusion of 3-record forms due to missing information on age

**Table 5:** Distribution of mechanism of injury by gender.

Gender	Fall	RTA	Other	Total
	n (%)	n (%)	n (%)	
Male	141 (59.9)	68 (24.5)	68 (24.5)	<b>227 (100)</b>
Female	102 (70.3)	20 (13.8)	23 (15.9)	<b>145 (100)</b>
<b>Total</b>	<b>243 (57.6)</b>	<b>88 (20.9)</b>	<b>91 (21.6)</b>	<b>422 (100)</b>

p=0.001

**Table 6:** Distribution of mechanism of injury by place of occurrence.

Place	At Home/Residence	At Workplace	At Educational institute	Other	Not recorded	Total
	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)
RTA	0 (0)	6 (16.2)	1 (1.3)	78 (73.6)	3 (10.3)	88(20.9)
Sports	8 (4.7)	0 (0)	14 (17.5)	3 (2.8)	1 (3.4)	26 (6.2)
Occupational injury	0 (0)	1 (2.7)	0 (0)	1 (9)	0 (0)	2 (5)
Fall	142 (83.5)	12 (32.4)	57 (71.3)	15 (14.2)	17 (58.6)	243 (57.6)
Violence/Assault	3 (1.8)	9 (24.3)	2 (2.5)	5 (4.7)	3 (10.3)	22 (5.2)
Hit by an object	11 (6.5)	9 (24.3)	4 (5)	4 (3.8)	3 (10.3)	31 (7.3)
Other	6 (3.5)	0 (0)	2 (2.5)	0 (0)	2 (6.9)	10 (2.4)
<b>Total</b>	<b>170 (100)</b>	<b>37 (100)</b>	<b>80 (100)</b>	<b>106 (100)</b>	<b>29 (100)</b>	<b>422 (100)</b>

**Table 7:** Significance of mechanism of injury by place of occurrence.

Mechanism of Injury	Injury at home/Residence	Injury at road	Injury at other places	Total
	n (%)	n (%)	n (%)	
RTA	0 (0)	78 (73.6)	10 (6.8)	88 (20.9)
Fall	142 (83.5)	15 (14.2)	86 (58.9)	243 (57.6)
Other	28 (16.5)	13 (12.3)	50 (34.2)	91 (21.6)
<b>Total</b>	<b>170 (100.0)</b>	<b>106 (100.0)</b>	<b>146 (100.0)</b>	<b>422 (100)</b>

mechanism which happened in the road and other places; this was statistically significant (p=0.000).

Table 8 shows around 62.1% have undergone coronal restorations. 30.6% of patients have undergone root canal treatments and 7.1% have received extractions. Only 7.3 % have undergone extra-coronal restorations. Upper incisors were the most treated teeth out of which upper central incisors were the most restored tooth with 34.8% and 33.9% both left and right respectively. Endodontic treatments also follow the same pattern with upper central incisors have undergone the highest number of endodontic treatments with 11.8% and 14.7% in both left and right respectively.

**UL1/2- Upper left central /Lateral Incisor tooth  
UR1/2 Upper right central /Lateral Incisor tooth**

As presented in Table 9 Only 34.5% of the patients were presented within the same day or the next day of the trauma.

the patterns were similar during the COVID -19 Lockdown period and the pre – Covid periods with 33% and 35.7% respectively. only with slight increase (2.7%) of the late presentations were noted during the lockdown period. The observed deference was not statically significant. (P>0.05)

Table 10 shows 51.9% of the trauma patients have made 3-4 visits to complete the treatment. The treatments were completed in 1-2 visits about 14.2% of the patients. this was increased from 2.6% to 28.3% during the COVID-19 lockdown period. The need of the patients to visit over 4 visits were reduces from 52.4% to 11.5% during the lockdown period. The observed deference was statically significant. (P<0.05).

Table 11 shows increase of the home injuries from 29.4% during pre-COVID period to 53.4% during the lockdown period. The observed deference was statically significant. (P<0.05).

**Table 8:** Treatment Outcome.

Treatment Outcome	UL2	UL1	UR1	UR2	Total number in each treatment Outcome (%)
	n (%)	n (%)	n (%)	n (%)	
Restorations	35 (8.3)	147 (34.8)	143 (33.9)	41 (9.7)	262 (62.1)
Root canal treatments	15 (3.6)	50 (11.8)	62 (14.7)	16 (3.8)	129 (30.6)
Extra coronal Restorations	7 (1.7)	8 (1.9)	16 (3.8)	5 (1.2)	31 (7.3)
Extractions	5 (1.2)	12 (2.8)	11 (2.6)	6 (1.4)	30 (7.1)
Other treatment	17 (4)	37 (8.8)	43 (10.2)	15 (3.6)	58 (13.7)

UL1/2: Upper left central /Lateral Incisor tooth; UR1/2: Upper right central /Lateral Incisor tooth

**Table 9:** Comparison of time of presentation after the Traumatic dental injury by pre-COVID-19 and COVID-19 lockdown scenario.

Time of presentation	Pre- COVID - 19	During COVID- 19 Lockdown	Total
	n (%)	n (%)	
Presented on the same day or the next day	79(35.7)	61(33.0)	140 (34.5)
Late presentation	142(64.3)	124(67.0)	266 (65.5)
<b>Total</b>	<b>221 (100.0)</b>	<b>185 (100.0)</b>	<b>406 (100.0)</b>

**Table 10:** Comparison of the mean number of visits the patient made to Complete the treatment.

Number of visits	Pre- COVID - 19	During COVID- 19 Lockdown	Total
	n (%)	n (%)	
1-2 visits	6 (2.6)	54 (28.3)	60 (14.2)
3-4 visits	104 (45.0)	115 (60.2)	219 (51.9)
Over 4 visits	121 (52.4)	22 (11.5)	143 (33.9)
<b>Total</b>	<b>231 (100.0)</b>	<b>191 (100.0)</b>	<b>422 (100.0)</b>

p=0.000

**Table 11:** Comparison of place of traumatic dental injury by pre-COVID-19 and COVID-19 lockdown scenario.

Place of Injury	Pre- COVID - 19	During COVID- 19 Lockdown	Total
	n (%)	n (%)	
Home/Residence	68 (29.4)	102 (53.4)	<b>170 (40.3)</b>
Road	67 (29.0)	39 (20.4)	<b>106 (25.1)</b>
Other	96 (41.6)	50 (26.2)	<b>146 (34.6)</b>
<b>Total</b>	<b>231(100.0)</b>	<b>191(100.0)</b>	<b>422 (100.0)</b>

p=0.000

**Table 12:** Comparison of mechanism of injury by pre-COVID-19 and COVID-19 lockdown scenario.

Mechanism of Injury	Pre- COVID - 19	During COVID- 19 Lockdown	Total
	n (%)	n (%)	
Fall	123(53.2)	120(62.8)	<b>243(57.6)</b>
Road Traffic accident (RTA)	59(25.5)	29(15.2)	<b>88(20.9)</b>
Other	49(21.2)	42(22.0)	<b>91(21.6)</b>
<b>Total</b>	<b>231(100.0)</b>	<b>191(100.0)</b>	<b>422(100.0)</b>

p=0.02 \* (\*Chi-square test)

Table 12 shows Comparison of the mechanism of injury by pre-COVID-19 and COVID-19 lockdown scenario. This revealed fall as the main mechanism of injury with 53.2% occurred during pre-covid 19 whereas 62.8% have occurred during covid lockdown. The observed difference was statistically significant (p<0.05).

## Discussion

In the present study, only 35.5% of the patients who attended the NDTH Sri Lanka during 48 months sought immediate care straight away or the day following the trauma, while 15.5% sought treatment two weeks after the trauma. An Australian study obtained similar findings and described only one-third (33.3%) of patients presented to a dentist within 24 hours of a dental injury [14]. The same study reported that the remaining two-thirds of patients delayed seeking treatment for up to one year [14]. The possible reason may be a lack of knowledge about the importance of obtaining immediate care following the dental trauma of many patients and parents. This notion has been expressed by a published study [10] Furthermore, accessibility and availability of dental care could be influential factors for the delay in presenting for care as supported by literature [15]. As the patient takes a long time to appear for the treatment, these patients (and their parents) may be unable to recollect what specifically happened at the time of the injury; this recall bias may affect the result.

In the present study, fall was the leading cause of dental

traumatic injury (57.5%). This is in agreement with the study of Sandalli et al. [16], in which falls account for the most common etiological factor (45.1%). The most interesting finding from this study was the considerable increase in falls that caused traumatic dental injuries throughout the COVID-19 lockdown period (62.8%) compared to the pre-COVID-19 era (53.2%). This observed difference was significant (P<0.05). Other studies also produced similar results where falls contributed to trauma in the pre-COVID-19 (51.7%) and the COVID-19 periods (68.2%) [9]. In a Wuhan study, it increased from 35.0% in the pre-COVID-19 time to 89.0% during the COVID-19 time [11]. Furthermore, studies have reported, during the COVID-19 locked down period, there was a decrease in vehicular and passenger travel, leading to a drop in Road Traffic Accident (RTA) [17], which is presently considered as the primary cause of injuries and hospitalization in Sri Lanka [18-20]. In the current study it clearly shows a significant reduction of Dental traumatic injuries associated with RTA from 25.5% to 15.2% (P<0.05) pre and post COVID-19 eras respectively.

In this study, the most common place where traumatic injuries occurred was at home (40.3%). Many other studies, including an Austrian survey [21] which stated home as the most common place of injury (34.3%), have constantly reported 'home' as the primary location for experiencing dental trauma. In the current study, there is a rise in the incidence of TDI occurred in patient's homes during the COVID lockdown period (53.4%) compared to the pre-COVID- 19 period (29.4%); and the difference was

significant ( $p < 0.000$ ). Therefore, the COVID-19 lockdown scenario may have mediated the more occurrence of traumatic dental injuries in the home environment since both adults and children spent more time at home.

The present study similarly found that traumatic injuries to teeth were more common among males (65.6%) than females (34.4%), and it is in conformity with findings from a similar study done in Australia, which showed male (64.8%) dominance [16]. This may be because males are more involved in rigorous physical activity than females whilst gender is a known confounder for dental traumatic injuries. Similar findings reported by a previous study [15]. In this study, Male: Female ratio was 1.9:1, and many other studies have proved that males faced more trauma than females in the traumatic injuries by a ratio ranging from 1.3 to 2.5:1, respectively [14]. It has been suggested that males had a greater tendency towards contact sports and intense actions [22].

Age is another commonly documented risk factor and a confounder where studies indicate that trauma occurrence was skewed towards the younger populations like children, adolescents, and young adults [1]. In this study, 80.7% of injuries were found with patients up to 35 years of age. Moreover, the dominant age group was between 11-20 years (33.9%), followed by 0-10 years (25.1%) and 20-29 years (22.2%). Similarly, an Australian study shows 92% of traumatic dental injuries occurred before 34 years [14]. It also mentions that these injuries were prominent in the 0 - 4 year and 10 - 14 year groups.

This study includes patients ranging from 3 to 71 years with a mean age of 22.75 years thus demonstrating vulnerability across all age groups for traumatic dental injuries as described previously. This was similar to the mean age of 21.6 years of the Wuhan study done during the same period, demonstrating that the economically productive age group has been affected in both countries [11].

The most frequent type of dental hard tissue injury noted in this study was the uncomplicated crown fractures. These fractures involve both enamel and dentine of the tooth without the involvement of the pulp. In the current study, 67.2% of patients showed uncomplicated crown fractures. The maxillary central incisors were the topmost teeth to get fractured, where 52.4% and 55.1% were noted in maxillary central incisors right and left respectively. Other studies have reported similar findings (71.9% with Stockwell [21] and 63.6% in Warren et al. [15], which involve the maxillary central incisor during the trauma. Even though uncomplicated crown fractures in the permanent dentition were recognized as the most common type of traumatic dental injury, this has ramifications for epidemiological studies as many of these injuries are not perceived as requiring treatment [1].

The central incisors may be more susceptible to traumatic dental injuries because of their location in the dental arch [4]. It is well documented that increased incisal over-jet increases the risk of traumatic injuries to teeth [23].

In the present study, 39.1% of patients had sustained oral soft tissue injuries. Findings from other studies with younger populations reveal that only around 14 - 18% of children with dental trauma had injuries to their soft tissues [24].

It is difficult to predict the results of dental trauma; therefore, it is more challenging to precisely determine the prognosis of injuries [1]. The study revealed 4.7% of the cases developed early and late complications due to the traumatic injury. The prognosis of some injuries is dependent on early and appropriate management [1]. Patients who are faced with dental traumatic injuries need to be mindful that certain injuries require multiple visits and/or subsequent reviews over time.

As per the study results, the most frequent treatment outcome was the coronal restorations (62.1%) followed by the root canal treatments (30.6%). Ekanayake and co-workers produced similar results, disclosing that most of the traumatized permanent teeth required pulp therapy (31.7%), ranging from pulpotomy to root canal treatment as the treatment of choice [10]. Findings of the same study reflected the notion of the present with regard to delay in seeking treatment by patients encountering traumatic dental injuries, as half of the patients had sought treatment more than 1 month after the trauma occurred [10].

The study was conducted in the NDTH in the Colombo as the study setting was convenient to the investigators. There are many other oral and maxillofacial and Restorative specialist centers throughout Sri Lanka where dental traumatic injuries were treated. Therefore, results of this study could not be generalized to the entire population of dental trauma patients in Sri Lanka. We find this as a main limitation in our study. Outcome would have been better if the study was carried out in clusters of oral and maxillofacial and Restorative specialist centers through the island.

Moreover, findings of present study should be interpreted cautiously considering the inherent limitation of a study of this nature. A retrospective data collection based on clinical records does not allow a comprehensive assessment of variables of interest. Further, there could be various biases such as recall bias, inter-operator biases and confounders that could have influenced the present findings. Furthermore, within the scope of the study logistic regression modeling was not employed and chi-square tests were used with the aim of conducting further research in this regard using the present findings as a pilot study. Further research is necessary with a larger cross-



section of the community to support the level of evidence in this study.

## Conclusion

As emerged from the findings of the present study, there was a wide variation of ages from toddlers to older adults presented for restorative treatment due to dental trauma demonstrating their vulnerability across all ages overwhelmingly dominated by male gender. Almost two thirds of them received coronal restorations whilst nearly a one-third got root canal treatment as main outcome, it was also evident from this study that a significant delay occurs in seeking dental treatment following TDI.

Therefore, awareness programs directed to patients and parents should be performed to educate them about the importance of immediate management of traumatic dental injuries, giving a better prognosis of traumatized teeth. This can be easily initiated through primary health care level in Sri Lanka specially utilizing primary health care workers in the community such as public health midwife, public health inspectors and school dental therapists.

The main cause of dental traumatic injury was falls occurring at home with a significant increase during COVID-19 lockdown era which might lead to importance of raising awareness of the public in this regard with appropriate strategies. Furthermore, second main cause of TDI was revealed as road traffic injuries which also should be addressed in national level injury prevention programs since it is a major public health issue.

Moreover, further research warranted in this regard with rigorous methodologies and statistical modeling considering inherent limitations of present study.

## Conflict of Interest

The author has no conflicts of interest to declare.

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